# Venn Diagrams

Venn Diagrams are diagrammatic representation of sets, using geometrical figures like circles, triangles, rectangles, etc. Each geometrical figure represents a group as shown in the examples. The area common to two or more figures represent those elements which are common to two or more groups. There are various models in Venn Diagrams which we will discuss with examples.

VENN DIAGRAM – TYPE I

In these kind of questions, there are many geometrical figures representing different groups. Let's discuss this type with the help of the following example.
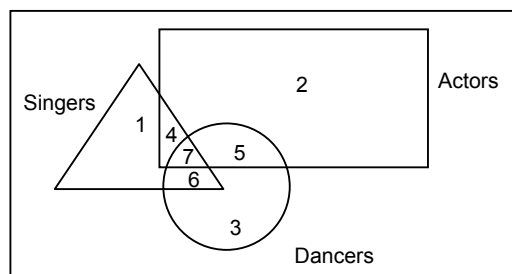
This diagram consists of three groups - Singers, Actors and Dancers, represented by a triangle, a rectangle and a circle respectively. There are seven regions represented by numbers from 1 to 7 where each region represents the following.

Region 1 → represents only Singers
Region 2 → represents only Actors
Region 3 → represents only Dancers
Region 4 → represents those Singers who are only Actors
Region 5 → represents those Actors who are Dancers only
Region 6 → represents those Dancers who are Singers only
Region 7 → represents those Singers who are Actors and Dancers

Hence, the various areas, as shown, represent different varieties, i.e., region 6 represents those Singers who are only Dancers, as region 6 is the intersection of the triangle and the circle, but not the square. You may be asked questions like "Which region represents Dancers who are only Singers?" The answer to this question, as explained above, will be region 6.

VENN DIAGRAM – TYPE II

In this type, two, three or four different groups could be given with some elements common to two or more groups. Let us observe the diagram given below.

Solved Examples

1. In a workshop there are 265 workers, out of which the total number of Fitters, Welders, and Drillers is 150, 160 and 140, respectively. There are 90 Fitters and Welders, 85 Welders and Drillers and 75 Drillers and Fitters and 50 workers who are Fitters, Drillers as well as Welders.
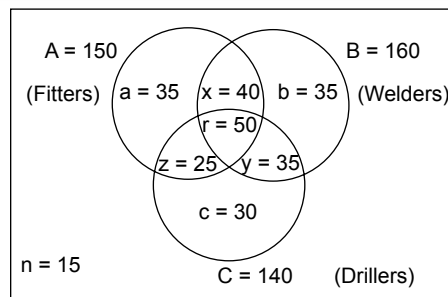
☝ **Solution:** Based on the information given, we get the following diagram.
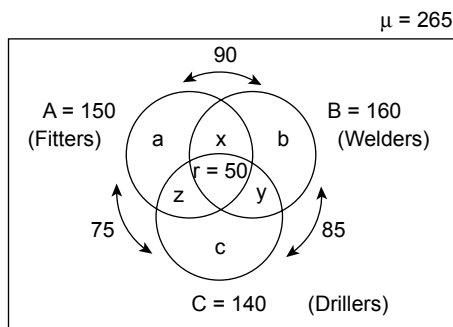
Now, $x = 90 - 50 = 40$; $y = 85 - 50 = 35$;

$z = 75 - 50 = 25$

Also, $a = 150 - (x + r + z)$

$= 150 - (40 + 50 + 25) = 35$

$b = 160 - (x + r + y)$

$= 160 - (40 + 50 + 35) = 35$

$c = 140 - (z + r + y)$

$= 140 - (25 + 50 + 35) = 30$

Hence, we get the following diagram:

Now, A or B or C $= (a + b + c) + (x + y + z) + r$

$= 150 + 35 + 35 + 30 = 250$

Now, we can answer the questions of the following nature.

a. What is the total number of people who are neither Fitters, nor Welders nor Drillers?

☝ **Solution:** $n = \mu - (A \text{ or } B \text{ or } C) = 265 - 250 = 15$

b. How many workers are not Fitters?

☝ **Solution:** not $A = \mu - A = b + y + c + n = 35 + 35 + 30 + 15 = 115$

c. How many fitters are not welders.

☝ **Solution:** A but not B (A − B) = a + z (i.e., the regions of A excluding B) $= 35 + 25 = 60$

d. How many fitters are welders but not both.

☝ **Solution:** A or B but not A and B $= (a + z) + (b + y)$ $= (35 + 25) + (35 + 35) = 130$

VENN DIAGRAM TYPE – III

In this type, Venn diagrams are used to establish relationships between the given groups. In other words, two or more groups are given and the Venn diagram, which most correctly establishes a relation between them, has to be chosen out of the various Venn diagrams given in the choices. Let us look at some of the examples given below.

a. Family, Father, Son:
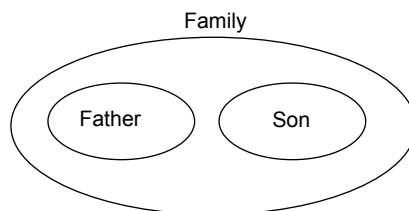
Here, a family consists of many members, to which father and son belong. The above diagram most appropriately represents these relations.

b. Bus, Train, Aeroplane:

Bus   Train   Aeroplane
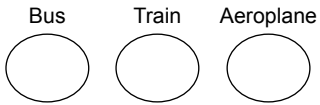
As there is nothing in common between these three different modes of transports, hence they should be disjoint (non-interesting) sets. No set should be a subset of any other set.

c. Land, Ocean, Forest:
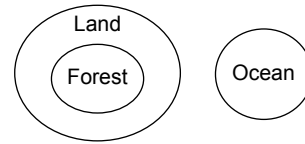
Land

Forest   Ocean

Land and Ocean are distinct, but forest is in land or forest is subset of land. Hence, the given diagram is the most appropriate representation of the given groups. Based on the above models, solve the questions given in the exercise.

Directions for questions 1 to 4: These questions are based on the following information.

In a survey, it was found that 80 youngsters in a locality liked only Cricket. 45% of the youngsters liked only Football. 5% of the youngsters liked both Cricket and Football. 10% of the youngsters liked neither Cricket nor Football.

1. How many youngsters like exactly one game?
  (1) 90   (2) 180
  (3) 170   (4) 200

2. How many youngsters do not like any of the two games?
  (1) 10   (2) 20
  (3) 90   (4) 70

3. How many youngsters like only Football?
  (1) 80   (2) 100
  (3) 300   (4) 90

4. How many youngsters like at least one game?
  (1) 20   (2) 180
  (3) 200   (4) 90

Directions for questions 5 to 8: These questions are based on the following information.

In a meeting, there are 100 politicians. Among them 35 are RK party supporters, 45 are JS party supporters and 20 support both the parties.

5. How many politicians do not support any of the two parties?
  (1) 40   (2) 45
  (3) 35   (4) 25

6. How many politicians support at least one party?
  (1) 55   (2) 60
  (3) 80   (4) 45

7. How many politicians support JS party only?
  (1) 20   (2) 80
  (3) 35   (4) 25

8. How many politicians are not the supporter of only one party?
  (1) 80   (2) 60
  (3) 35   (4) 65

Directions for questions 9 to 12: Study the following data and the table to answer the questions that follow.

A survey was conducted among 100 students in a class who read detective novels written by Conan Doyle or Agatha Christie or both. Due to some recording error in the computer most of the figures were missing. The following table shows the remaining data.

	Doyle	Christie	Both	Total
Male				
Female	40			
Total		70		100

Further, it is known that

(1) 37% of the students read both Doyle and Christie.
(2) The ratio of males to females is 1 : 1.
(3) 50% of the females read books of both the authors.

9. How many males read books by both the authors?
  (1) 10
  (2) 12
  (3) 37
  (4) 45

10. How many students read books by only Christie?
  (1) 70   (2) 10
  (3) 33   (4) 23

11. How many females read books by only Doyle?
  (1) 25   (2) 40
  (3) 35   (4) 15

12. How many students do not read books by both the authors?
  (1) 12   (2) 27
  (3) 37   (4) 63

Directions for questions 13 to 16: These questions are based on the following information.

In a marriage party, ice creams of three different flavours Vanilla, Strawberry and Chocolate are served. Among the guests, 100 guests have eaten Vanilla ice cream, 150 guests have eaten Strawberry ice cream and 170 guests have eaten Chocolate ice cream. 50 guests have eaten Vanilla and Strawberry ice creams. 60 guests have eaten chocolate and Strawberry ice creams. 30 guests have eaten Vanilla and Chocolate ice creams. 20 guests have eaten all the three flavoured ice creams and 80 guests have not eaten any ice cream.

13. How many guests have eaten the ice creams of at least two flavours?

(1) 190   (2) 100

(3) 150   (4) 180

14. How many guests have eaten the ice creams of Vanilla and Strawberry flavours only?

(1) 20   (2) 30

(3) 40   (4) 10

15. How many guests have eaten Vanilla ice cream and Chocolate ice cream but not Strawberry ice cream?

(1) 40   (2) 30

(3) 10   (4) 20

16. How many guests have not eaten the Vanilla ice cream?

(1) 170   (2) 150

(3) 250   (4) 280

Directions for questions 17 to 20: These questions are based on the following information.

In a music centre 'Sangeet Mahal' there were cassettes belonging to the various types of music. It was found that 125 cassettes were of Pop Music, 135 cassettes were of classical Music and 95 cassettes were of Light Music. 60 cassettes had a mixture of at least two of the music types and 10 cassettes had a mixture of all the three. Every cassette in the music centre contained at least one of the above mentioned types of music.

17. How many cassettes were of exactly two types of music?

(1) 60   (2) 50

(3) 100   (4) 90

18. How many cassettes had music of at least one type?

(1) 285   (2) 225

(3) 90   (4) 205

19. If the number of cassettes of only Pop Music is equal to that of only Light Music, which is twice of the number of cassettes of only Classical Music type, then how many cassettes of only Classical Music were there?

(1) 225   (2) 75

(3) 90   (4) 45

20. If the number of cassettes of only Pop Music is equal to 75 and the number of cassettes of both Pop and Classical but not Light is equal to the number of cassettes of both Pop and Light but not Classical, then how many cassettes are there in the Music Centre which are both Classical and Light but not Pop?

(1) 0   (2) 20

(3) 50   (4) 10

Directions for questions 21 to 24: These questions are based on the following diagram.

In the following figure, the Triangle represents the students who passed in Physics, the Rectangle represents the students who passed in Chemistry and the Circle represents the students who passed in Mathematics in a class.
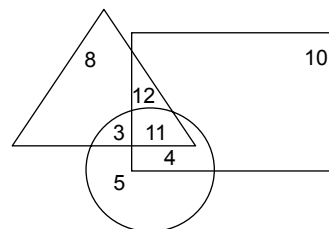
21. How many students passed in Mathematics only?

(1) 3   (2) 5

(3) 4   (4) 11

22. How many students passed in both Chemistry and Physics?

(1) 11   (2) 12

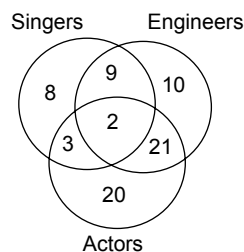(3) 23   (4) 15

23. How many students passed in Chemistry but not in Mathematics?

(1) 22   (2) 11

(3) 18   (4) 17

24. How many students passed in Mathematic and Physics but not Chemistry?

(1) 3   (2) 4

(3) 12   (4) 11

Directions for questions 25 to 28: These questions are based on the following Venn diagram.

25. How many Actors are not Engineers?

(1) 24   (2) 23

(3) 15   (4) 18

26. How many Singers are Actors but not Engineers?

(1) 8　　　　　　　　　(2) 3
(3) 9　　　　　　　　　(4) 21

27. How many Engineers are either Singers or Actors but not both?

(1) 25　　　　　　　　(2) 28
(3) 35　　　　　　　　(4) 30

28. How many Singers are Actors as well as Engineers?

(1) 21　　　　　　　　(2) 9
(3) 3　　　　　　　　　(4) 2

Directions for questions 29 to 32: The following Venn diagram represents the 1200 employees of a company. Each of the employees is a member of at least one of three clubs – A, B and C. Using the given data, answer the questions that follow.
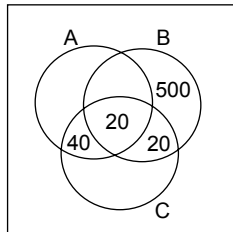
Total member of club A = 420
Total member of club B = 590
Total member of club C = 340

29. How many employees are member of both club A and club B?

(1) 50　　　　　　　　(2) 80
(3) 70　　　　　　　　(4) 60

30. How many employees are not member of club B?

(1) 340　　　　　　　(2) 610
(3) 630　　　　　　　(4) 290

31. How many employees are member of club A or club C?

(1) 850　　　　　　　(2) 700
(3) 975　　　　　　　(4) 675

32. How many employees are member of exactly two clubs?

(1) 110　　　　　　　(2) 130
(3) 98　　　　　　　　(4) 7

Directions for questions 33 to 36: In each question a group of words is given which can be represented by one of the four diagrams given below. Observe the diagrams carefully and mark the number of the figure as you answer which would best represents the group of words given in each question.
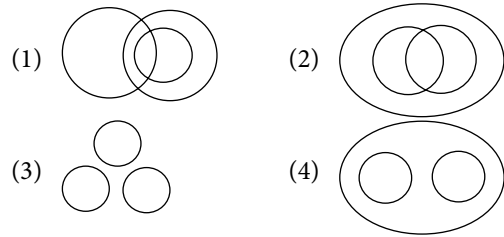
33. Flowers, Marigold, Rose.

34. India, China, Australia.

35. Males, Doctors, Fathers.

36. Odd numbers, Natural numbers, Real numbers.

Directions for questions 37 to 40: These questions are based on the following Venn diagram.

In this diagram, there are two numbers in each segment, one atop the other. The number at the top represents the number of male and the number at the bottom represents the numbers of female.
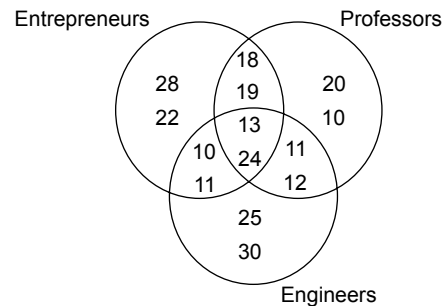
37. How many Professors are neither Entrepreneurs nor Engineers?

(1) 20　　　　　　　　(2) 28
(3) 30　　　　　　　　(4) 38

38. How many male Professors are not Entrepreneurs?

(1) 29　　　　　　　　(2) 31
(3) 49　　　　　　　　(4) 58

39. How many females are not Engineers?

(1) 51　　　　　　　　(2) 48
(3) 58　　　　　　　　(4) 60

40. How many Professors are also Entrepreneurs as well as Engineers?

(1) 37　　　　　　　　(2) 40
(3) 48　　　　　　　　(4) 51

Directions for questions 1 to 4: These questions are based on the following information.

In a class of 150 students, 45 take History, 65 take Geography and 10 take both History and Geography.

1. How many take only History?
   (1) 65
   (2) 35
   (3) 10
   (4) 45

2. How many do not take either History or Geography?
   (1) 10
   (2) 35
   (3) 100
   (4) 140

3. How many students take at least one subject?
   (1) 10
   (2) 90
   (3) 50
   (4) 100

4. How many students do not take any of the two subjects?
   (1) 90
   (2) 10
   (3) 50
   (4) 100

Directions for questions 5 to 8: These questions are based on the following information.

In a survey conducted among 200 mobile phone using families, it was found that 140 use Panasonic, 120 use Nokia and 143 use Siemens. 95 use both Panasonic and Nokia, 85 use both Nokia and Siemens and 93 use both Panasonic and Siemens. 70 families use mobile phones of all the three companies.

5. How many families use mobilephones of both Panasonic and Nokia but not Siemens?
   (1) 25
   (2) 57
   (3) 165
   (4) 95

6. How many families use mobilephones of exactly one Company?
   (1) 63
   (2) 67
   (3) 70
   (4) 200

7. How many families use neither Panasonic nor Siemens?
   (1) 40
   (2) 120
   (3) 80
   (4) 10

8. How many families use none of the mobile phones?
   (1) 10
   (2) 70
   (3) 0
   (4) 20

Directions for questions 9 to 12: These questions are based on the following information.

In a certain locality, 44% of the residents read *Indian Express*, 35% read *The Hindu* and 43% read *The Times of India*. 10% read all the three. Also 15% read both *Indian Express* and *The Hindu*, 16% read both the *Hindu* and *The Times of India* and 17% read both *Indian Express* and *The Times of India*. 64 residents do not read any newspaper.

9. How many residents read exactly two newspapers?
   (1) 18
   (2) 64
   (3) 72
   (4) 108

10. How many residents read exactly one newspaper?
    (1) 204
    (2) 248
    (3) 154
    (4) 224

11. What is percentage of the residents who read only "*The Hindu*" to those who read only "*The Times of India*"?
    (1) 50%
    (2) 30%
    (3) 60%
    (4) 70%

12. What is the ratio of the number of residents who read *The Indian Express* to that of those who read only *The Times of India*?
    (1) 10 : 6
    (2) 11 : 5
    (3) 11 : 10
    (4) 44 : 43

Directions for questions 13 to 16: These questions are based on the following information.

In a locality, three magazines are read, namely *India Today*, *Sports Star* and *Business India*. 45 people read only one magazine, 20 read exactly two magazines and 5 read all the three. There is no one who does not read any of the three magazines.

13. How many people read at least two magazines?
    (1) 25
    (2) 20
    (3) 50
    (4) 45

14. If the ratio of people who read *India Today* is to those who read *Sports Star* is to those who read *Business India* is 2 : 3 : 4 and 18 people read *India Today*, then how many read *Sports Star*?
    (1) 28
    (2) 31
    (3) 36
    (4) 27

15. If 10 people stop reading *India Today* and start reading *Business India*, then what is the maximum number of people who read exactly two magazines?

(1) 20   (2) 30

(3) 25   (4) 55

16. What percentage of the people who read at least one magazine read exactly two magazines?

(1) 25%   (2) 20%

(3) $28^4/_7\%$ (4) 70%

Directions for questions 17 to 20: These questions are based on the following information.

In a class of 150 students, 70 students passed in Physics and 90 passed in Statistics. 10 students failed in both the subjects.

17. How many students passed in both the subjects?

(1) 20   (2) 160

(3) 40   (4) 140

18. What percentage of students who passed in at least one subject, failed only in Statistics?

(1) 70   (2) 105

(3) 280   (4) 50

**19.** What percentage (approximately) of students who passed in Physics also passed in Statistics?

(1) 14   (2) 42

(3) 36   (4) 29

20. How many students passed in exactly one subject?

(1) 160   (2) 120

(3) 140   (4) 20

Directions for questions 21 to 24: These questions are based on the following diagram.

In the following diagram, the Circle represents all the people who like Maaza, the Square represents all the people who like Thums up, the Triangle represents all the people who like Marinda and the Rectangle represents all the people who like Coca-Cola.
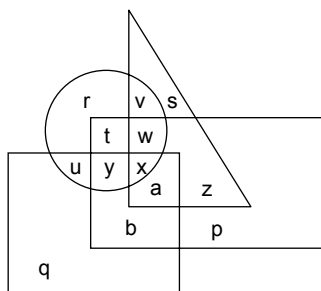
21. Which of the following represents the people who like Marinda but not Thums up?

(1) v, s, w, x   (2) v, s, z, a

(3) v, w, x, a   (4) v, s, w, z

22. Which of the following represents the people who like Maaza and Thums up?

(1) u, t, w   (2) v, w, x

(3) b, a, x   (4) u, y, x
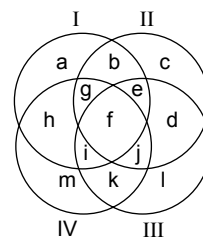
23. Which of the following represents the people who like both Maaza and Marinda but not any of other two?

(1) y   (2) v

(3) u   (4) b

24. Which of the following represents the people who like Marinda, Maaza, Coca-cola but not Thums up?

(1) b   (2) r

(3) s   (4) w

Directions for questions 25 to 28: These questions are based on the following diagram.

In the above diagram,

Circle I represents the athletes who participated in Swimming.

Circle II represents the athletes who participated in Running.

Circle III represents the athletes who participated in Javelin throw.

Circle IV represents the athletes who participated in Long jump.

25. Which of the following represents the athletes who participated in Running and Swimming?

(1) 1, g, e, f   (2) a, b, c

(3) g, e, f   (4) b, g, e, f

26. Which of the following represents the athletes who participated in all the four events?
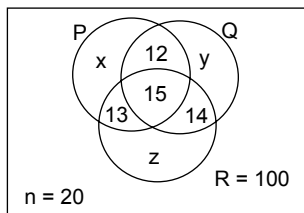
(1) g   (2) j

(3) i   (4) f

27. Which of the following represents the athletes who participated in exactly three of the four events?

(1) h, b, k, d (2) g, e, i, j
(3) a, c, d, k (4) f, j, k, i

28. Which of the following represents the athletes who participated in Swimming and Javelin throw but not in Running?

(1) j (2) g
(3) k (4) i

Directions for questions 29 to 32: These questions are based on the following Venn diagram.

P represents the number of students who have voter ID card.

Q represents the number of students who have Passport.

R represents the number of students who have PAN card.

n represents the number of students who do not have any of the three ID proofs i.e., Voter ID card, Passport and PAN card.

29. If the number of students who have voter ID card is half of the number of students who have PAN card then, how many students have only voter ID card?

(1) 10 (2) 20
(3) 15 (4) 15

30. How many students have neither voter ID card nor Passport?

(1) 64 (2) 50
(3) 78 (4) 72

31. If $\dfrac{x}{y} = \dfrac{2}{1}$ and $\dfrac{y}{z} = \dfrac{1}{2}$ then how many students have only voter ID card?

(1) 60 (2) 58
(3) 29 (4) 18

32. If x = y = z, then how many students do not have PAN card?

(1) 120 (2) 138
(3) 160 (4) None of these

Directions for questions 33 to 36: In each question, a group of words is given which can be represented by one of the four diagrams given below. Observe the diagrams carefully and mark the number of the figure as you answer which would best represents the group of words given in each question.
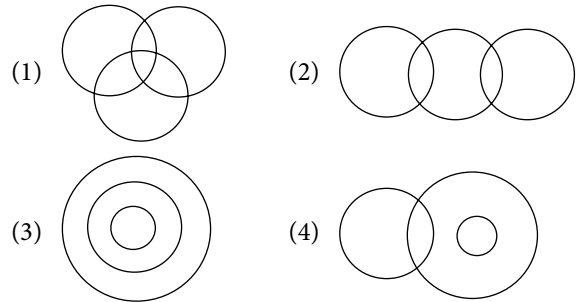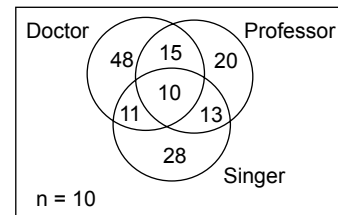

33. Beverages, Cold drinks, Coca-cola.

34. Professors, Doctors, Cardiologists.

35. Females, Doctors and Engineers.

36. Singers, Dancers, Actors.

Directions for questions 37 to 40: These questions are based on the following Venn diagram.

37. How many Professors are Doctors but not Singers?

(1) 12 (2) 11
(3) 15 (4) 13

38. How many Singers are Doctors as well as Professors?

(1) 15 (2) 11
(3) 13 (4) 10

39. How many Doctors are not Singers?

(1) 50 (2) 78
(3) 79 (4) 63

40. How many persons are either Professors or Singers but not both?

(1) 34 (2) 48
(3) 68 (4) 74

ANSWER KEYS

PRACTICE EXERCISE 5 (A)

1. 3	**2.** 2	**3.** 4	**4.** 2	**5.** 1	**6.** 2	**7.** 4	**8.** 2	**9.** 2	**10.** 3
11. 4	**12.** 4	**13.** 2	**14.** 2	**15.** 3	**16.** 4	**17.** 2	**18.** 1	**19.** 4	**20.** 4
21. 2	**22.** 3	**23.** 1	**24.** 1	**25.** 2	**26.** 2	**27.** 4	**28.** 4	**29.** 3	**30.** 2
31. 2	**32.** 1	**33.** 4	**34.** 3	**35.** 1	**36.** 2	**37.** 3	**38.** 2	**39.** 1	**40.** 1

PRACTICE EXERCISE 5 (B)

1. 2	**2.** 4	**3.** 4	**4.** 3	**5.** 1	**6.** 2	**7.** 4	**8.** 3	**9.** 3	**10.** 4
11. 4	**12.** 2	**13.** 1	**14.** 4	**15.** 1	**16.** 3	**17.** 1	**18.** 4	**19.** 4	**20.** 2
21. 4	**22.** 4	**23.** 2	**24.** 4	**25.** 4	**26.** 4	**27.** 2	**28.** 4	**29.** 1	**30.** 3
31. 2	**32.** 4	**33.** 3	**34.** 4	**35.** 2	**36.** 1	**37.** 3	**38.** 4	**39.** 4	**40.** 4